Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Bromus inermis* Leyss. (USDA 2005)
Synonyms:	None identified by USDA (2005).
Common names:	Smooth brome, awnless brome. Hungarian bromegrass
Evaluation date (mm/dd/yy)**:**	03/24/04
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Committee review date:	10/22/04
List date:	10/22/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**B**	Reviewed scientific publication	**"Impact"** **Section 1 Score:** **B**	**"Plant Score"** **Overall Score:** **Medium** **Alert Status:** **None**
1.2	Impact on plant community	**B**	Other published material		
1.3	Impact on higher trophic levels	**C**	Other published material		
1.4	Impact on genetic integrity	**C**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**B**	Observational	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **13 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**B**	Observational		
2.3	Recent trend in total area infested within state	**C**	Observational		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**B**	Other published material		
2.6	Potential for natural long-distance dispersal	**B**	Observational		
2.7	Other regions invaded	**C**	Other published material		
3.1	Ecological amplitude	**A**	Observational	**"Distribution"** **Section 3 Score:** **B**	RED FLAG **YES** Something you should know.
3.2	Distribution	**D**	Observational		

Red Flag Annotation

Bromus inermis should not be used for reclamation purposes in wildlands because of its persistence and invasive potential.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **B** *Doc'n Level:* **Rev. sci. pub.**
Identify ecosystem processes impacted: Smooth brome populations modify or retard natural succession. Smooth brome is resistant to fire, which may disrupt natural fire regimes in some prairie and forest systems. It spreads extensively via rhizomes and binds soil altering geomorphological status and affecting surface water availability.
Rationale: A Canadian study (Grilz and Romo 1994) demonstrated that smooth brome is apparently resistant to fire effects in Fescue Prairie. Native species are suppressed by burning in the same system, which causes fire to possibly increase smooth brome populations. In ponderosa pine systems where fire is a natural process and the vegetation is adapted to fire, smooth brome populations may inhibit this process, or alter the frequency. Based on test plot observations at the Arboretum at Flagstaff, smooth brome did not carry fire effectively (W. Albrecht, personal observations, 2004). Smooth brome is used for erosion control and streambank stabilization. Rhizomatous cultivars become sod-bound after several years unless litter is removed by grazing and/or fire. This sod forming mat of rhizomes could effect geomorphological changes by preventing the absorption of surface water that could potentially affect the water availability for nearby plants. Due to cloning, smooth brome is a long-lived species. Plantings have been known to persist for at least 60 years, which may limit natural succession in some ecotypes. Individual rhizomes are reported to have longevity of one year. Old brome fields develop a "sod bound" condition in which shoot density is reduced and symptoms of nitrogen deficiency are exhibited (Meyers and Anderson 1942). This condition could be attributed to a carbon/nitrogen imbalance (perhaps because of the sheer mass of dead rhizomes) creating a potential for alteration of soil chemistry.
Sources of information: See cited literature; also observations by W. Albrecht (Natural Resources Educator and SFPWMA Coordinator, University of Arizona, Coconino County Cooperative Extension, Flagstaff, Arizona, 2004).

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **B** *Doc'n: Level:* **Other pub.**
Identify type of impact or alteration: Smooth brome has been widely planted as a forage and cover crop, and at reclamation/restoration sites and it is highly persistent. It forms a dense sod that often appears to exclude other species, thus contributing to the reduction of species diversity in natural areas. One study suggests smooth brome plants produce an allelopathic substance to inhibit its own root development.
Rationale: A restoration treatment at the Arboretum at Flagstaff, removed smooth brome from a meadow and results demonstrated that both abundance and diversity of natives are lower in the presence of smooth brome, supporting Elliot's (1949) assertion that smooth brome can out compete native species (Albrecht et al. In Press). In Rocky Mountain National Park, smooth brome is currently believed to be expanding from road shoulders. It is found in some areas disturbed within the last 11 to 50 years, and may be inhibiting natural succession processes. Smooth brome is highly competitive and may displace more desirable vegetation. In some cases, it appears to be invading native prairie areas in plains region from roadsides (USGS 2004). Smooth brome is an invasive perennial in fescue prairies in North America. It is planted extensively for the stabilization of disturbed sites, it spreads aggressively by seeds and rhizomes and eventually gains dominance of the site and suppresses other plants. In Manitoba, Canada, smooth brome was the most competitive of several introduced species and excluded native species (Wilson 1989, Wilson and Belcher 1989).

Grant and Sallans (1964) suggest that the decomposing roots may actually produce an allelopathic substance inhibitory to further brome root development. It is not noted whether this substance has negative effects on native plants. A study in Sweden carried out from 1976 to 1985 examined establishment of plant cover on zinc mine wastes. Plant cover percentages were measured after 2 years and at 10 years from planting. Smooth brome constituted only a minor part of the mixed-grass stand, which included (*Poa pratensis, Dactylis glomerata, Festuca rubra,* and *Agrostis tenuis).* This study revealed that smooth brome does not possess invasive qualities, or could be outcompeted by the other exotics or adventive natives established on the site (Bergholm and Steen 1989).

Sources of information: See cited literature.

Question 1.3 Impact on higher trophic levels *Score:* **C** *Doc'n Level:* **Other pub.**

Identify type of impact or alteration: Smooth brome is highly palatable and has fair to good nutritional as well as cover potential for birds and small mammals. Although some studies demonstrated that it was not the preferred food of some mammals, suggesting that it may be utilized because other more favorable species are not available.

Rationale: Grazing wildlife use smooth brome to varying degrees, depending upon wildlife species and smooth brome quality and time of year. A study by Hobbs et al. (1981) showed that elk use it as a winter food in Colorado. Mule deer in central Utah were found to graze smooth brome only lightly, but deer utilization of smooth brome is generally considered good. Geese and small rodents such as pocket gophers also graze smooth brome. The seeds may not be preferred by granivores. Everett and others (1978) found that when offered the seed of 18 herbaceous species, deer mouse selected smooth brome seed the least. Smooth brome provides cover for birds and small mammals. Ducks, gray partridge, American bittern, northern harrier, and short-eared owl use it as nesting cover.

Sources of information: See cited literature; also see Howard (1996) and Duebbert and Lokemoen (1977).

Question 1.4 Impact on genetic integrity *Score:* **C** *Doc'n Level:* **Other pub.**

Identify impacts: Smooth brome hybridizes readily with *Bromus pumpellianus*.

Rationale: Considerable hybridization and introgression have occurred between smooth brome and Pumpelly brome (*B. pumpellianus*), a native species which occurs in Michigan, eastern Utah, and the Rocky Mountains (Walsh 1994, USDA 2005). Elliot (1949) suggested that *B. pumpellianus has* been reduced to a subspecies of *B. inermis* due to the extensive introgression between the two. Welsh et al. (1987) could find no material belonging to the native strain. Smooth brome does not hybridize with other North American *Bromus* species.

Sources of information: See cited literature; also see Kearney and Peebles (1960), Armstrong (1981), and Sather (1987).

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **B** *Doc'n Level:* **Obs.**

Describe role of disturbance: Smooth brome has been widely seeded along roads and in stabilization projects. It generally invades after disturbance and persists. Heavy grazing also increases smooth brome infestations, but it may spread into undisturbed areas.

Rationale: Smooth brome is a common invader of disturbed prairie throughout the Great Plains. Boggs and Weaver (1992) reported that along the Yellowstone River, moderate grazing increased the occurrence of shrubs in mature eastern cottonwood, and severe grazing converted the area to smooth brome, timothy (*Phleum pratense*), and Kentucky bluegrass (*Poa pratensis*). In Pipestone National Monument (Minnesota) it has been known to invade undisturbed habitat. Personal observations by L. Moser (2004) and W. Albrecht (2004) suggest that disturbance is necessary for establishment.

Sources of information: Boggs et al. (1992), Howard (1996), Southwest Exotic Plant Information Clearinghouse (SWEPIC; http://www.usgs.nau.edu/SWEPIC/): Pipestone National Monument Alien Plant Ranking System ranking. Also observations by L. Moser (Botanist, Coconino National Forest, USDA Forest Service, Flagstaff, Arizona, 2004) and W. Albrecht (Natural Resources Educator and SFPWMA Coordinator, University of Arizona, Coconino County Cooperative Extension, Flagstaff, Arizona, 2004).

Question 2.2 Local rate of spread with no management *Score:* **B** *Doc'n Level:* **Obs.**
Describe rate of spread: Increases, but less rapidly.
Rationale: Persistent populations in and around ranch settlements in Oak Creek Canyon in northern Arizona, the Arboretum, and V-bar-V ranch; rate of spread is slow but is occurring.
Sources of information: Observations by J. Bradley (U.S. Forest Service).

Question 2.3 Recent trend in total area infested within state *Score:* **C** *Doc'n Level:* **Obs.**
Describe trend: Stable
Rationale: In the past, this plant was widely planted as a pasture grass but presently, the working group consensus is that this species seems to be stable within that state and is not expanding its range.
Sources of information: Working Group discussions.

Question 2.4 Innate reproductive potential *Score:* **A** *Doc'n Level:* **Other pub.**
Describe key reproductive characteristics: Produces by seeds and rapid-forming rhizomatous root systems.
Rationale: Smooth brome is a rhizomatous, sod-forming species. The first adventitious roots develop within 5 days of germination. The number of seeds produced has a very wide range. Lowe and Murphy (1955) report 47 to 160 seed heads per plant, with 156 to 10,080 viable seeds per plant. Seed has remained viable for 22 months to over 14 years.
Sources of information: See cited literature; also see Sather (1987), SWEPIC (http://www.usgs.nau.edu/SWEPIC/): Grand Canyon National Park Alien Plant Ranking System ranking.

Question 2.5 Potential for human-caused dispersal *Score:* **B** *Doc'n Level:* **Other pub.**
Identify dispersal mechanisms: Smooth brome is planted extensively for erosion control, forage and revegetation throughout the Midwest and western U.S., and is spread throughout transportation corridors such as highways and railroads. Boggs and Weaver (1992) found that grazing activities increase smooth brome invasions on the Yellowstone River. Smooth brome has been used in post-fire revegetation.
Rationale: Human dispersal occurs, but not at a high level.
Sources of information: See cited literature; also see Sather (1987).

Question 2.6 Potential for natural long-distance dispersal *Score:* **B** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Seeds may be transported by ants, or short distances by wind and water, but generally rare dispersal occurs more than 1 km by animals and abiotic mechanisms. Regular flooding of watersheds/drainages can transport this species longer distances (>1km).
Rationale: Kramer (1975 in Sather 1987) suggests that seeds may be transported and sequestered by ants, resulting in creation of new brome patches on anthills.
Sources of information: See cited literature. Score based on Working Group observations and discussion.

Question 2.7 Other regions invaded	*Score:* **C** *Doc'n Level:* **Other pub.**
Identify other regions: In North America smooth brome occurs from Alaska and all the Canadian provinces and territories south to southern California and New Mexico, northern Oklahoma, and North Carolina. Smooth brome is a Eurasian species ranging from France to Siberia, apparently introduced in the United States by the California Experiment Station in 1884 (Kennedy 1899, Archer and Branch 1953). Within the United States smooth brome has been introduced in the northeastern and northern Great Plains states as far south as Tennessee, New Mexico and California. It has become naturalized from the maritime provinces to the Pacific coast north to Alaska to California and through the plains states. In Colorado from Rocky Mountain National Park records, smooth brome is found in openings in mountain brush, pinyon juniper, aspen, spruce fir, ponderosa pine, lodgepole pine, and meadow communities. In Utah, smooth brome is found along roads and waterways and in fallow fields from 1280 to 3240 m, and in openings in mountain brush, pinyon-juniper, aspen, spruce-fir, ponderosa pine, lodgepole pine and meadow communities and is known from every Utah county with the exception of Grand (Welsh et al. 1987). In New Mexico, smooth brome is in all counties excepting the eight easternmost that border Texas.	
Rationale: Invades elsewhere but only in ecotypes that it has already invaded in the state.	
Sources of information: See cited literature; also see the Atlas of the Vascular Plants of Utah (accessed online on February 10, 2004 at: http://www.gis.usu.edu/Geography-Department/utgeog/utvatlas/ut-vascatlas.html.), Grasses of New Mexico, New Mexico State University Range Science Herbarium, Texas A&M Bioinformatics. (Working Group accessed online at: http://www.csdl.tamu.edu/FLORA/cgi/newmex_taxa_page?all=yes.), and Baldwin et al. (2002).	

Question 3.1 Ecological amplitude	*Score:* **A** *Doc'n Level:* **Obs.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: First collection of smooth brome was from Schultz Creek in Coconino county in 1945. Smooth brome is widely adapted to a variety of sites. It is common in riparian zones, valley bottoms, and dryland sites. It is adapted to all soil textures, although it may not thrive on sand or heavy clay. Smooth brome tolerates acid and saline soils but it does not grow on soils that are more than moderately alkaline. Smooth brome grows best on moist, well-drained soils, but tolerates poorly drained soils. Based on observations of Working Group members, smooth brome tolerates moderate shade to full sun.	
Rationale: Smooth brome distribution is widespread, invading six major and nine minor ecotypes. In Arizona smooth brome is widespread in the northern half of the state.	
Sources of information: SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed February 2004), USGS (2004), SWEMP-Cain Crisis map (available online at: http://cain.nbii.gov/cgibin/mapserv?map=../html/cain/crisis/crisismaps/crisis.map&mode=browse&layer=state&layer=county; accessed February 2004), and personal observations.	

Question 3.2 Distribution	*Score:* **D** *Doc'n Level:* **Obs.**
Describe distribution: Limited	
Rationale: Although smooth brome is in lots of ecological types it occurs at a low frequency.	
Sources of information: Based on Working Group observations and discussion. Also see sources in Question 3.1.	

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**Yes**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**Yes**	**No**	**2 pt.**
Populations of this species produce seeds every year.	**Yes**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**Yes**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**Yes**	**No**	**2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes**	**No**	**1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**No**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**No**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**Yes**	**No**	**1 pt.**

Total pts: 11 Total unknowns: 0

Score : A

Note any related traits:

Worksheet B. Arizona Ecological Types

(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	**D**
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	**D**
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	**U**
	montane wetlands	**D**
	playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	**D**
	montane riparian	**D**
Woodlands	Great Basin conifer woodland	**D**
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	**D**
	montane conifer forest	**D**
Tundra (alpine)	tundra (alpine)	

*A. means >50% of type occurrences are invaded; B means >20% to 50%; C means >5% to 20%; D means present but ≤5%; U means unknown (unable to estimate percentage of occurrences invaded).

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